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Utah Science

Utah State UNIVERSITY

A Publication of the Utah Agricultural Experiment Station at Utah State University

Volume 61 Number 3 Summer 2002

story

". . . makes Millville silt loam among the best characterized and understood soils in the world . . ."

Cultivating plants on the same piece of land for 100 years is no small accomplishment in a society where most people are more familiar with corn chips than corn stalks and many mail more change of address cards than Christmas cards. So 100 years of research at the Utah Agricultural Experiment Station's Greenville Farm is an anniversary worth commemorating. But the feature that makes the place an outstanding outdoor laboratory got its start so long ago that 100 years seems like no time at all.

Between 10 and 32 thousand years ago, Lake Bonneville covered much of Northern Utah. When the lake receded, water flowed out of the canyons around Cache Valley shaping the landscape and depositing a number of geological gifts, including the soft, fertile soil at what is now the Greenville Farm.

Millville silt loam may not be a liltingly beautiful name, but merely mention it to soils scientist Janis Boettinger and she enthusiastically describes its truly beautiful characteristics, beginning with the sort of unqualified endorsement scientists rarely utter, "It's the best soil in Cache Valley."

Boettinger says very little sand, 17 percent clay, low salinity, no rocks down to five feet, a "champion" nitrifier population, high water holding capacity and more than 40 percent calcium carbonate combine to make Millville silt loam prime agricultural soil. But you don't find this soil just anywhere. In fact, after searching several soil surveys, Boettinger finds this particular soil only at the Greenville farm and in a small area in nearby Box Elder County. If the climate allowed a slightly longer growing season the Greenville farm would be rated class one agricultural land, but with about 120 days in the average growing season it gets rated class two. Researchers can't afford to lose many of those precious growing days which makes the soil even more valuable.

"We can work the soil at Greenville just two days after a spring rain," says Ray Cartee, director of UAES farms. "Other places in the valley have heavier, clay soils and we have to wait for them to dry out which means you're losing days for doing field work."

Having 100 years of data about the soil, climate, chemicals, water and plants on the site and Utah State's longstanding program in soil physics make Millville silt loam among the best characterized and understood soils in the world and the foundation for good science.

"When a scientist does research they want to control all the variables that can be controlled," Cartee says. "Field work isn't tidy and exact like working in a lab. There are so many variables you cannot control that having all the data on the soil, water and nutrients is critical."

Cartee is among the many researchers who have invested countless days in the Greenville soil. Visit the farm nearly any day from spring through fall and you'll find faculty, undergraduates and graduate students at work on an amalgam of experiments all aimed at understanding irrigated agriculture and meeting the changing needs of people in the Intermountain West.

You may even find new generations of students in a soil pit learning to read the soil profile, repeating Boettinger's mantra, "Life on Earth would not exist without soil," and taking home some history under their fingernails.

KERMIT L. HALL, PRESIDENT, UTAH STATE UNIVERSITY

H. PAUL RASMUSSEN, DIRECTOR, UTAH AGRICULTURAL EXPERIMENT STATION
NOELLE E. COCKETT, DEAN, COLLEGE OF AGRICULTURE

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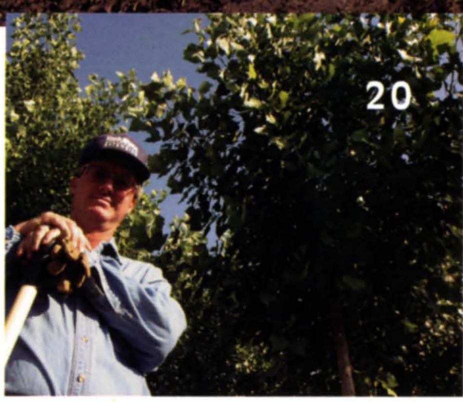

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Lynnette Harris, Editor,
lynnette@agx.usu.edu

Dennis Hinkamp, Research Writer,
dennish@ext.usu.edu

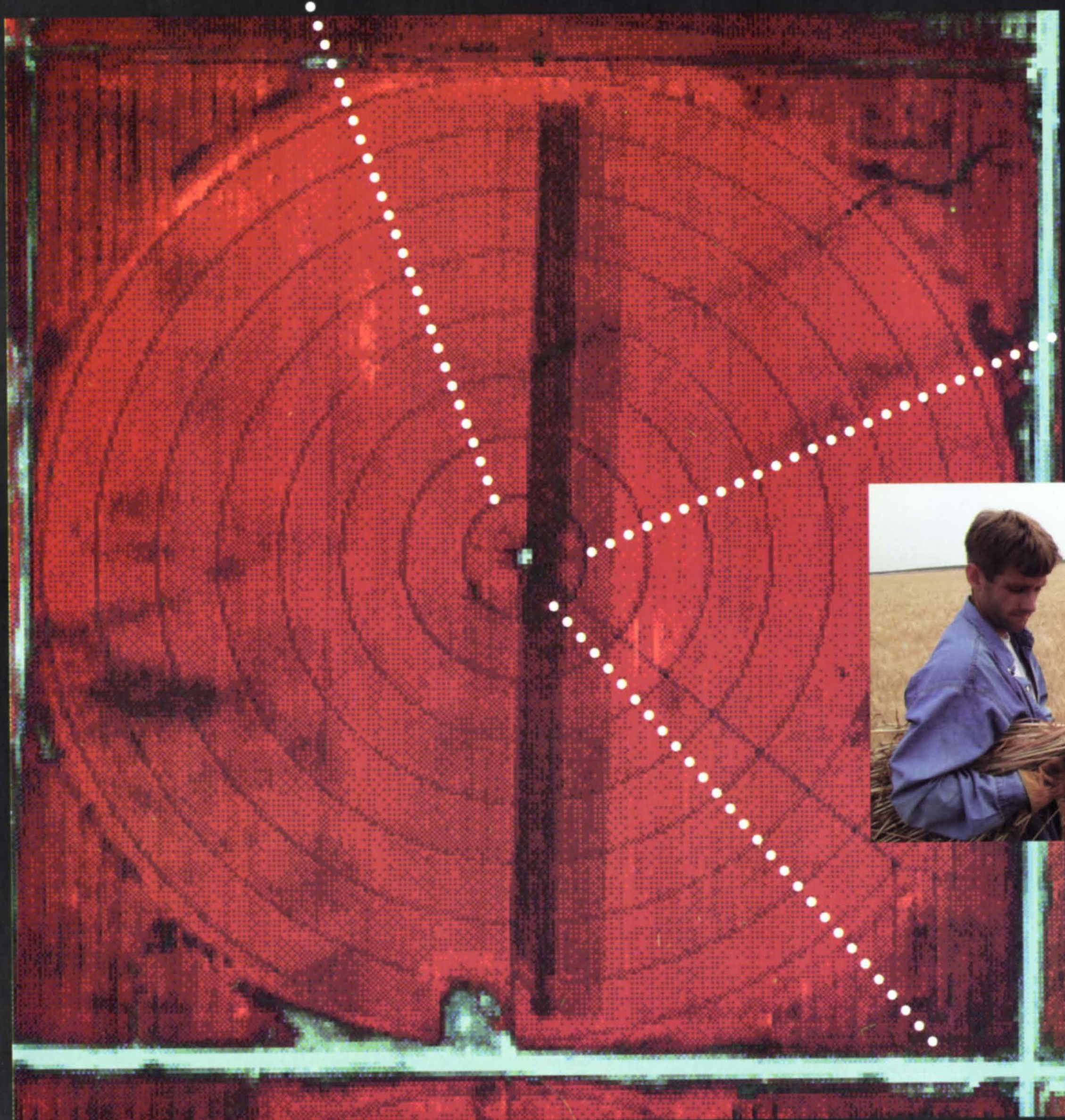
Mary Donahue, Graphic Artist,
mdonahue@cc.usu.edu

Gary Neuenswander, Media Specialist,
gary@agx.usu.edu

Michael Smith, Webmaster,
mike.smith@usu.edu

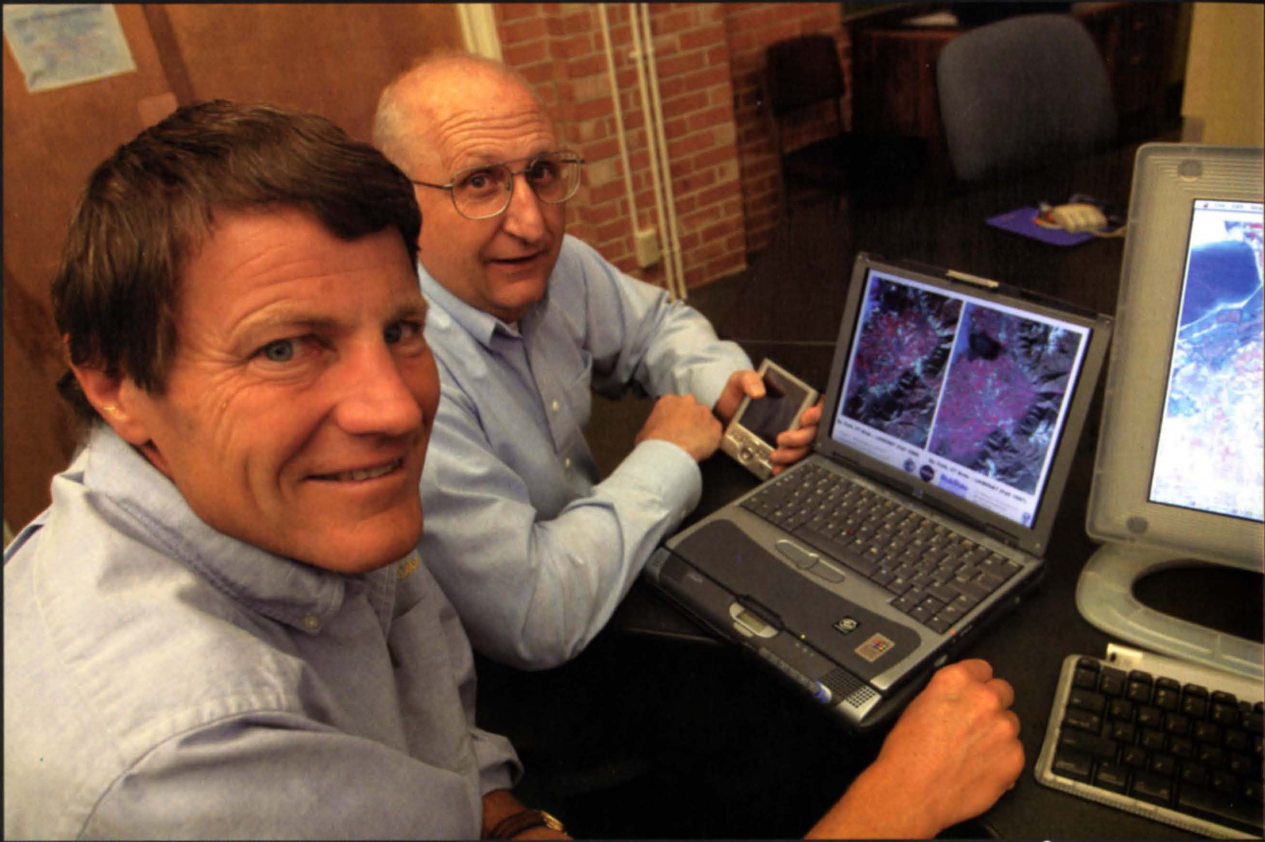
ON THE COVER: Near infrared and visible composite satellite image (IKONOS) of irrigated farm plots in Minidoka, Idaho.

GROWING WHEAT FROM SPACE



Above, Dennis Wright gathers wheat to check nitrogen levels. Left, an infrared satellite image of irrigated crops.

Bruce Bugbee, left, and Phil Rasmussen work together on a grant from NASA and the USDA Initiative for Future Agriculture and Food Systems Program to apply GPS technology to agriculture.



Gary Neuenswander

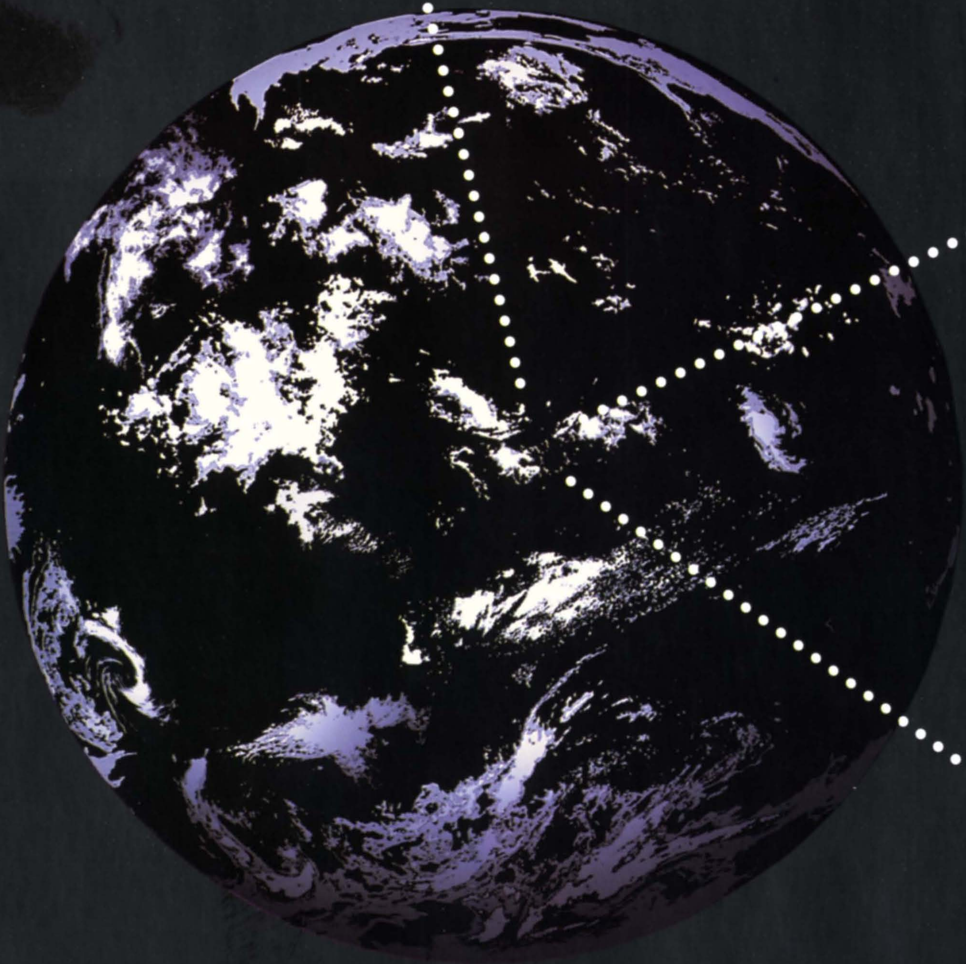
While growing wheat in space may feed space travelers of the future, growing wheat from space can help feed millions of people now. One of the greatest dividends of the cold war has been all the GPS (Global Positioning System) technology that is now available to the public. Only recently has this technology been applied to agriculture.

Phil Rasmussen and Bruce Bugbee, Utah Agricultural Experiment Station researchers received a $650,000 grant from NASA and the USDA Initiative for Future Agriculture and Food Systems Program (IFAFS) to support research into remote sensing, as well as allow them to train county extension agents in this technology.

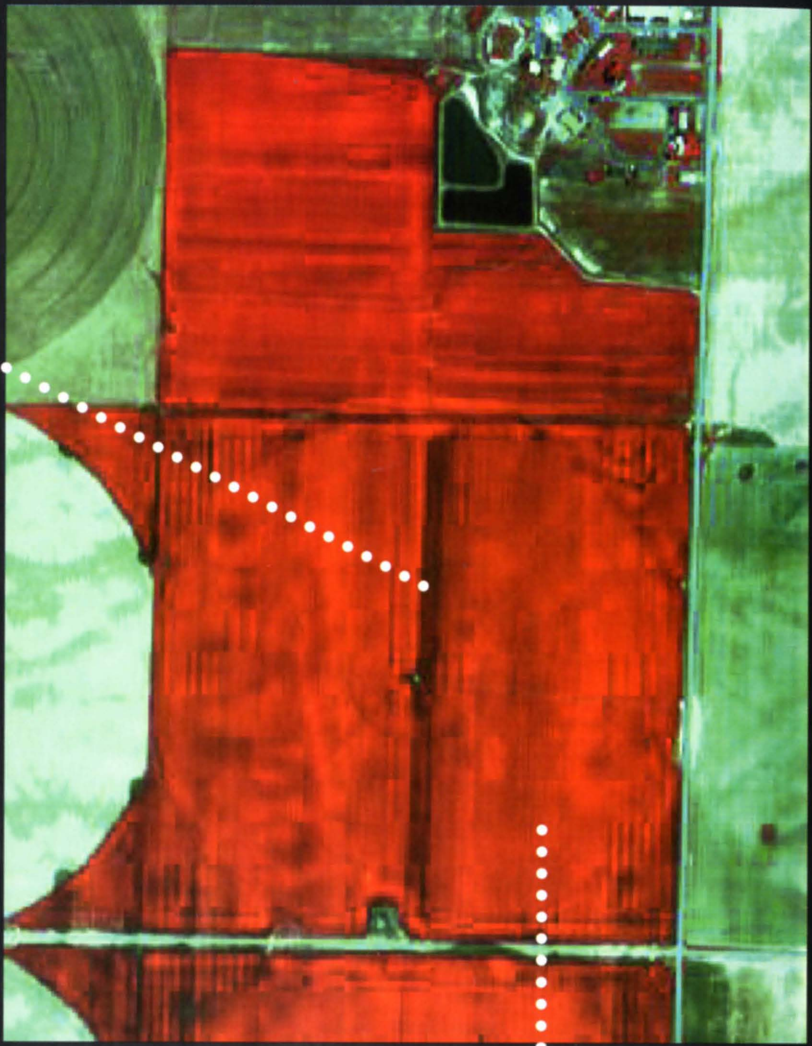
Hand-held GPS equipment puts this new technology in farmers' reach.

Rasmussen, the first geospatial extension specialist in the nation, has spent many years researching how remote sensing techniques can help farmers. Remote, or geospatial, sensing is the use of aerial and satellite images to survey an area, such as a farmer's field. It can be used in farming to detect a lack of nitrogen or water, weed infestations or other areas of poor yield. Rasmussen and Bugbee, ultimately, want to help farmers increase their profits. Bugbee supervises the USU greenhouses that are developing better crops for space travel and

“What funds me is trying to feed people in space,” Bugbee said. “What funds Phil’s projects is feeding people here on Earth.”

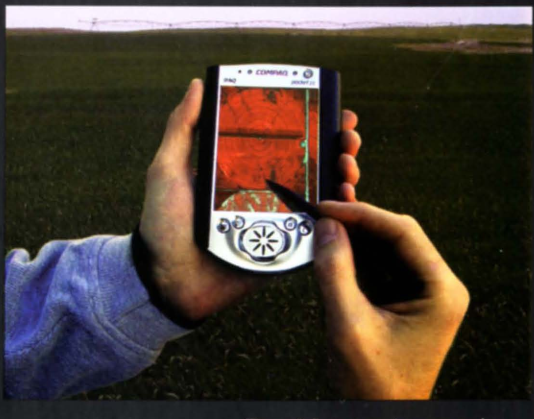


An infrared satellite image of irrigated crops. Black stripe down the middle of the center pivot indicates no applied nitrogen.



space stations. He is expert at developing crops in experiment chambers under predetermined conditions. The project will combine both of their talents.

"What funds me is trying to feed people in space, Bugbee said. "What funds Phil's projects is feeding people here on Earth."



Trouble spots can be located in the field by downloading data and satellite imagery.

The power of this project is linking these two skills. The title of their project is, "Validation and Application of Geospatial Information for Early Identification of Stress in Wheat," but the bottom line is trying to determine if remote sensing from satellites can increase farm productivity. The project is an effort to determine the effectiveness of using remote sensing to monitor wheat and then to transfer what the researchers learn to extension agents and farmers. One facet of the project involves using remote sensing to determine if a wheat research plot near Minidoka, Idaho suffers from a lack of nitrogen or water and then to correct the problem to optimize yield and quality. Other wheat plots at the UAES Greenville Farm are subjects of flyovers by

Phil Rasmussen demonstrates the new GPS technology to Utah farmers at a recent field day.

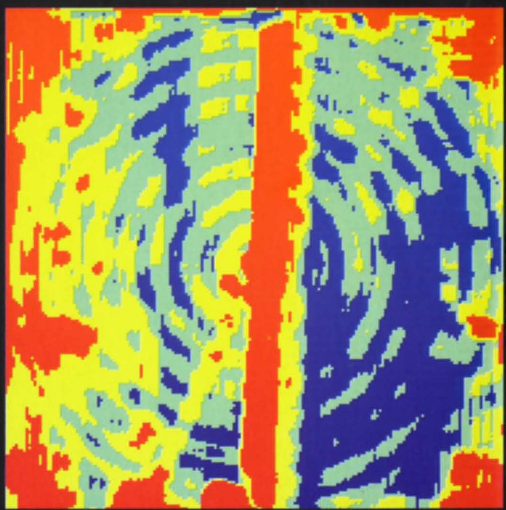
airplanes equipped with infrared cameras. There is also plenty of work to do on the ground as another component of the project includes researchers in the field using handheld infrared sensors and GPS monitors to test wheat growing subjected to water and nitrogen stress.

Clearly, if a simple method can be refined to simultaneously detect nitrogen and moisture stress, farmers would readily adopt this new technology, Rasmussen said. Environmental benefits would include less groundwater pollution or offsite contamination, as well as decreased energy, nutrient and irrigation inputs. In other words, a more profitable bottom line.

Nitrogen is one of the key limiting factors to the growth of wheat but testing for this deficiency has always been part art, science and economics. A trained eye can see the

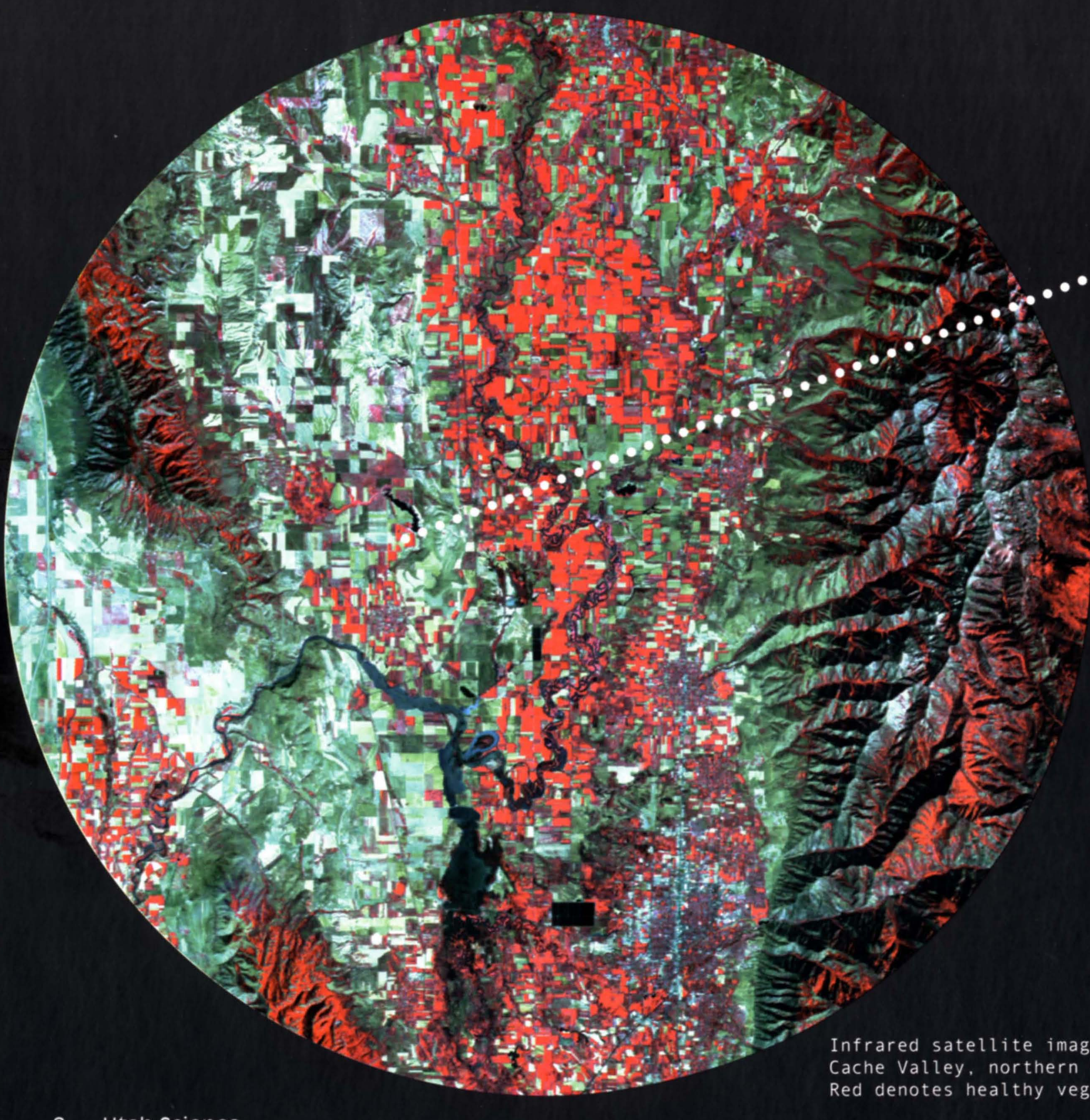
slight variations in color that indicate lower levels of nitrogen. Observation is simple and inexpensive but accuracy varies from farmer to farmer plus it is difficult to see the entire wheatfield at ground level. Plant tissue analysis is highly accurate, but expensive and must be repeated throughout the growing season.

Satellite imagery is potentially more efficient because there are a lot of things you just can't at detect at ground level, especially on larger operations Rasmussen says. For instance, a single sprinkler head that is clogged or broken could go undetected for the whole growing season, but a quick look at a satellite image can show areas of a field that aren't getting enough water. There has been a limited amount of crop analysis from airplanes, but the cost is, at times, prohibitive.



Infrared photo showing effects of irrigation, fertility and soil type. Blue shows very high yields, green - high yields, yellow - medium yields, and red - low yields.

Precision agriculture promises farmers the information they need to apply fertilizers,water and other inputs at the right time, the right amount and the right place.



Infrared satellite image of Cache Valley, northern Utah. Red denotes healthy vegetation.

While it may be initially frightening that you can quickly download a photo with a high enough resolution to count the lawn chairs in your back yard, you have to consider what this can do for agriculture. These photos are available from government satellites but satellite imagery is also becoming a commercial venture.

IKONOS, launched September 24, 1999, is the first commercial high-resolution satellite, collecting 1-meter panchromatic and 4-meter multi-spectral imagery. Although de-classified military high-resolution panchromatic data has been available from Russian sources for some years, IKONOS is a wholly commercial venture, providing data to an expanding remote sensing market.


Aerial view of Cache Valley farmland.

Satellite sensing will increase the use of precision agriculture, says Rasmussen. Though most crops are fertilized evenly across the acres, there are usually areas of the field that need more or less nutrients than others. The practice of uniform fertilizer application has been partially fueled by the lack of accurate information. Spreading fertilizer uniformly insures that there are no missed spots but it also means that some areas are getting more fertilizer than they need which can lead to run off or leaching into the water supply.

Precision agriculture promises farmers the information they need to apply fertilizers, water and other inputs at the right time, the right amount and the right place, he says. The results from the first year‘s field data support the accuracy of the IKONOS satellite data. What remains to be determined is the cost effectiveness of this system at detecting other nutrient deficiencies in crops and at what size operation this becomes more cost effective.

In the early days of research plots at the Greenville Farm the latest designs in weirs for measuring water in the canals was state-of-the-art and farmers probably considered crop dusting airplanes to be high technology at one time also. And now remote sensing helps farmers manage their crops at ground level with a little help from outer space.

— Dennis Hinkamp

Contact Info:
Bruce Bugbee
Professor of Crop Physiology, Plants, Soils & Biometeorology Dept., College of Agriculture
(435) 797-2765
bugbee@cc.usu.edu

Philip Rasmussen
Professor & Extension NASA Specialist, Plants, Soils & Biometeorology Dept., College of Agriculture
Director, Western Region SARE Program
(435) 797-3394
soilcomp@cc.usu.edu

Satellite and infrared image photographs courtesy of Philip Rasmussen.

EXPERIMENT STATION

—OF—

THE AGRICULTURAL COLLEGE

OF UTAH

BULLETIN NO. 2002

Photo from the Experiment Station of the Agricultural College of Utah, Bulletin No. 86, "The Right Way to Irrigate," *(Results of 1901)* published December, 1903. Logan, Utah

A part of the irrigation system. (Looking north-east.)

100 Years of Research and Science at the Greenville Farm

AUGUST 2002.

LOGAN, UTAH.

Among the experiments at the Greenville Farm are several providing new information about the irrigation and propagation of turf varieties and native plants.

Gary Neuenswander

There are plenty of things John A. Widtsoe would not recognize today about the Utah Agricultural Experiment Station's Greenville Farm, a place he helped establish during his tenure as UAES director from 1900-1905.

The wheat at Greenville would appear familiar, though the varieties growing there now reflect 100-plus years of careful genetic selection and improvement. He would understand the need to carefully examine plants being subjected to water and nitrogen stress, but the handheld infrared sensors, Global Positioning System technology and satellite imagery used in those experiments would be a bit mind boggling. And because Widtsoe was by all accounts a gifted scientist and intellectually curious man, he would certainly have questions about the ornamental plants, artichokes, asparagus and turfgrass growing on spots where he once studied alfalfa.

But one thing hasn't changed at Greenville since Widtsoe outlined the farm's mission. The research done there is still all about irrigated agriculture and making the best use of the state's limited water resources.

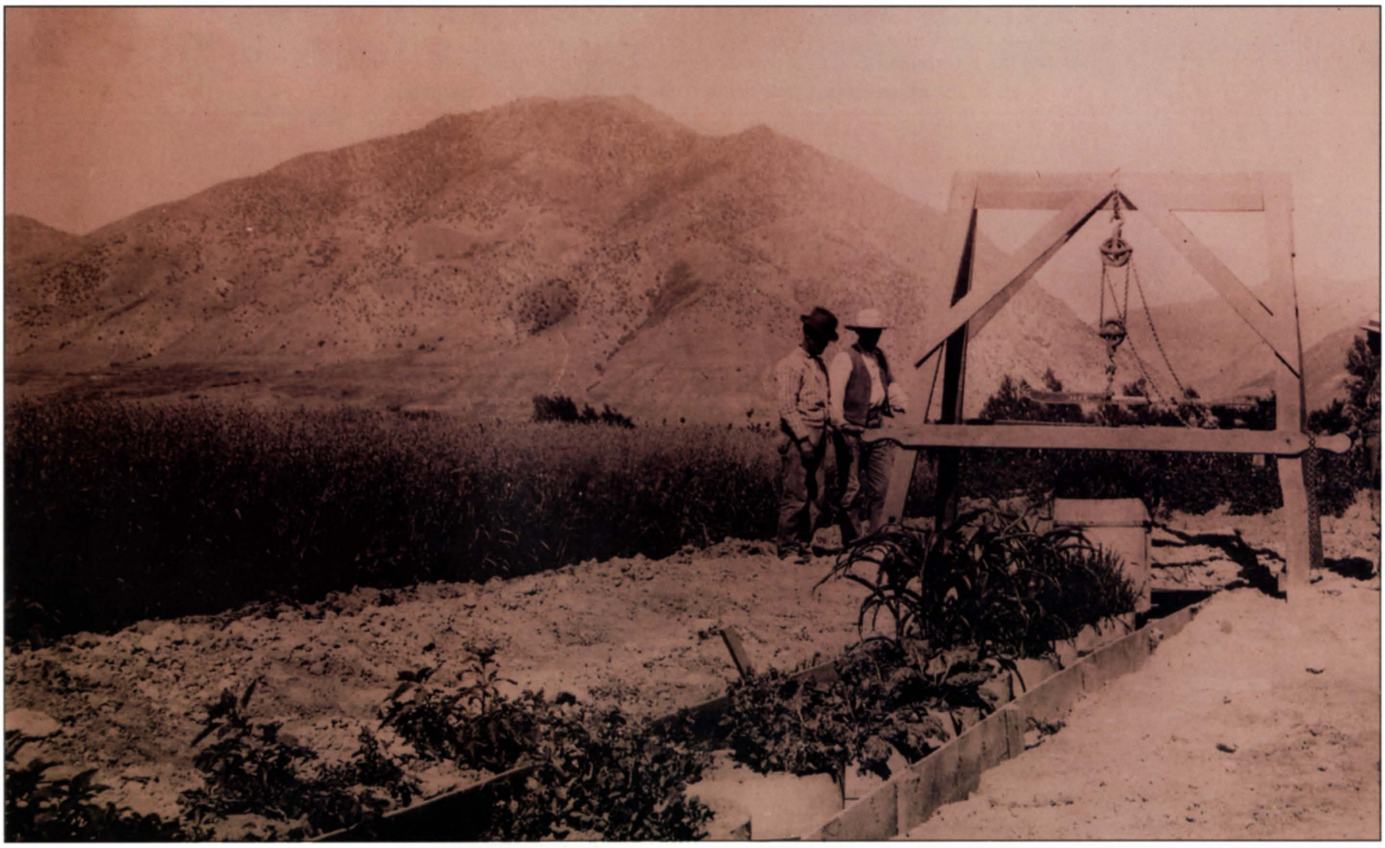
From the Prefatory Note, Bulletin No. 86, "The Right Way to Irrigate," (Results of 1901) published December, 1903. Logan, Utah

"This bulletin has been written by John A. Widstoe and W.W. McLaughlin. It is a popular expostition of some of the results found in Bulletin 80 of this station entitled "Irrigation Investigations on the College Farm in 1901," by John A. Widstoe, Geo. L. Swendsen, L.A. Merrill, W.W. McLaughlin, W.D. Beers and Osborne Widstoe.

The irrigation investigations of the Utah Experiment Station were instituted in 1901; and have been continued since that year. The results promise to be of the highest importance in the establishment of correct practices in the use of water on farms. In studying the diagrams and statements of the following pages it must be borne in mind that the experiments were performed on shallow, gravelly bench land, and that, therefore, in many cases, the results on the predominating, deep valley lands will be somewhat different. Since 1901, the experiments have been conducted on an especially provided farm, the soil of which is deep and uniform in texture."

Photo from the Experiment Station of the Agricultural College of Utah, Bulletin No. 75, "Arid Farming or Dry Farming," published January, 1902. Logan, Utah

Weighing pots, to determine the amount of water required by plants.



"The fact that the ancient and, to arid countries, indispensible art of irrigation lacks a scientific basis, is the justification of the decision taken two years ago by the officers of the Utah Experiment Station, to make irrigation the central subject of their investigations," Widtsoe wrote in 1903. "It seemed also eminently proper that Utah, the pioneer irrigation state, should lead out in such work."

The farm's original six acres in North Logan, a spot formerly known as Greenville, were purchased in 1901 and results from the some of the first experiments were published the following year. At various times since then, adjacent plots were purchased so that today the Greenville Farm includes 31 acres at the original site, plus 34 acres of cereals plots across the road and 10 nearby acres used for weed control experiments.

Since the time the first irrigation experiments were done at Greenville, records have been carefully kept of soil and air temperatures, precipitation, the location and kind of plants grown, irrigation regimes, chemicals used, making it one of the best characterized research sites anywhere. Historic records of the farm are critical to scientists today who need as much information as possible about a site in order to understand the results of their experiments amid all the difficult-to-control variables that accompany field research.

Guy Serbin, a PhD candidate and research assistant, uses a laser to study the movement of moisture through various soil types.

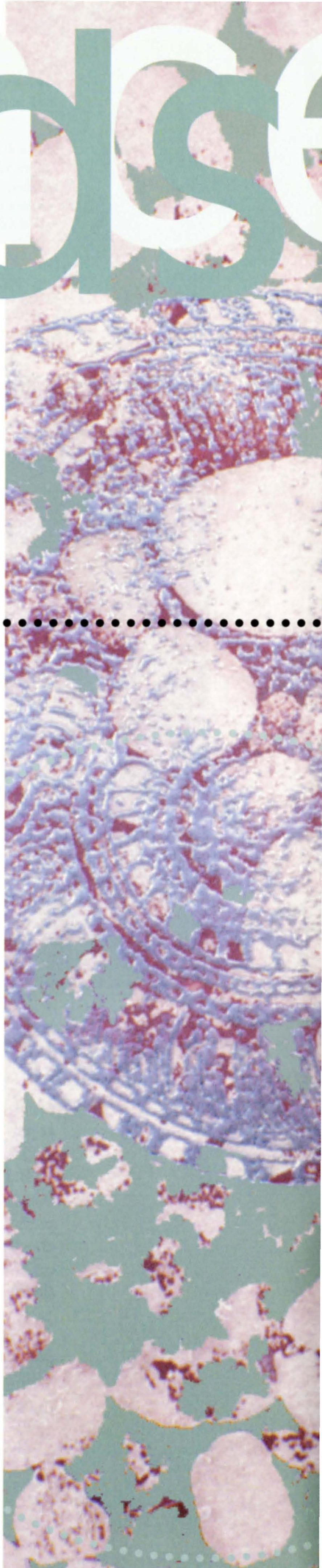
Gary Neuenswander

Currently, Greenville is home to rows of poplar trees being grown in an agroforestry experiment to determine how they can best be used to take excessive nutrients from soil, act as windbreaks and provide lumber and other wood products. There are corn and wheat fertility studies, and experiments aimed at understanding nitrogen cycling in crops treated with dairy manure. Tall, tangles of wispy ferns mark the location of asparagus variety trials that provide important information to growers working with this relatively small but highly profitable vegetable. Turf grass variety trials make one section of the farm look like a checkerboard putting green without the cups and flags, while other areas are covered with ornamental plants and trees, a reflection of the state's growing urban population and shrinking water supply.

While the technology in use has progressed from wooden weirs placed in canals to infrared instruments that detect plant stress, scientists remain committed to learning more about irrigated agriculture in Utah and building on the tradition of 100 years of research at the Greenville Farm.

— Lynnette Harris

Seeds



Don Jensen, director of the Utah Climate Center, creates evapotranspiration maps of the state with funding from the Utah Department of Agriculture and Food. The center also collects and analyzes weather data for the Great Salt Lake Desert with support from the U.S. Department of the Interior.

Child Care Resource and Referral provides training and support for daycare providers and assists parents in locating care for their children. **Ann Austin** leads the program which is funded by the Utah Department of Workforce Services. In addition, Austin also works with the agency's "Earn While You Learn" program.

Economist **Arthur Caplan** studies use of used oil recycling block grants with funding from the Utah Department of Environmental Quality.

"Biological Weed Control: Education and Implementation" is a project directed by **Philip Rasmussen** with funding from the Environmental Protection Agency.

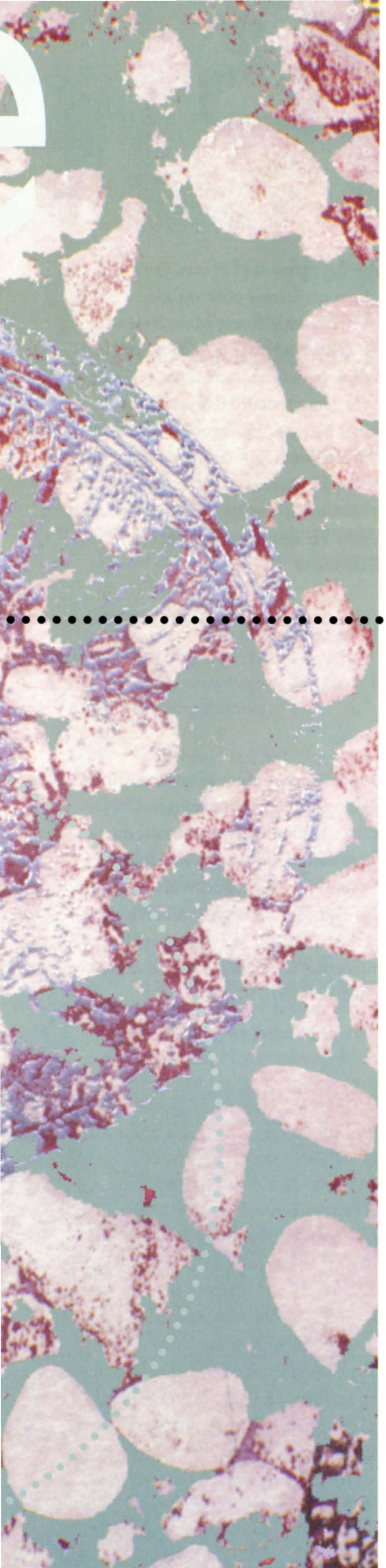
Robert Newhall is working to develop and monitor improved plants for revegetation of areas disturbed by fire and US Army activity. His research is supported by the USDA- Agricultural Research Service.

The USDA's Cooperative State Research, Education and Extension Service (CSREES) supports the Consortium for Application of Behavioral Principles to Management, an animal behavior research effort led by **Fred Provenza**.

Helen Berry studies the factors that impact rural migration for young and mid-age adults with support from the USDA/CSREES.

Value-added options for small dairy producers in the northern Rocky Mountains are investigated by **Don Snyder** with support from Rocky Mountain Farmers Union Cooperative.

Researchers in **Bruce Bugbee's** lab study the effects of ethylene on the development of salad crops that might be grown aboard the International Space Station. The research is supported by NASA. The lab is also investigating the abilities of crested wheatgrass to extract toxins from soils in cooperation with Bechtel/Idaho National Engineering and Environmental Laboratory.



Noelle Cockett works to characterize the causitive mutation of callipyge, a form of muscle hypertrophy in sheep. Her research is supported by the USDA/CSREES.

Turf specialist **Paul Johnson** investigates the gene flow from *Poa Pratensis* to other *Poa* species under field conditions with funding from Scotts Company.

Demonstrating hydro-zones as a tool to reduce overall water use in Intermountain landscapes is the focus of work conducted by **Bill Varga**. The project is supported by UDSA/ CSREES.

Bruce Godfrey conducts risk management programs for dairy operators in the western region in cooperation with Washington State University, and for specialty crop producers with support from the Utah Department of Agriculture and Food. He also leads a study of infrastructure and services costs for San Pete County, Utah.

Jeff Broadbent studies the genetics and biochemistry of capsule production in *streptococcus thermophilus* MR-1C with funding from the USDA/CSREES.

The Utah State Office of Education funds efforts to electronically enhance the agricultural science and technology curriculum for secondary schools, a project lead by **Dan Hubert**.

John Harrison leads a project investigating use of integrated facultative ponds as an alternative wastewater treatment system for dairy farms. The research is supported by the USDA/CSREES.

Jointed goatgrass is the subject of research by **John Evans**, in cooperation with Washington State University. Evans studies the influence of fallow tillage on jointed goatgrass emergence and competition in winter wheat and the best management practices to control the grass in wheat in the intermountain area.

The flow and distribution of water and other fluids through porous media (such as clay chips) in microgravity is the subject of investigations led by **Dani Or** and supported by NASA.

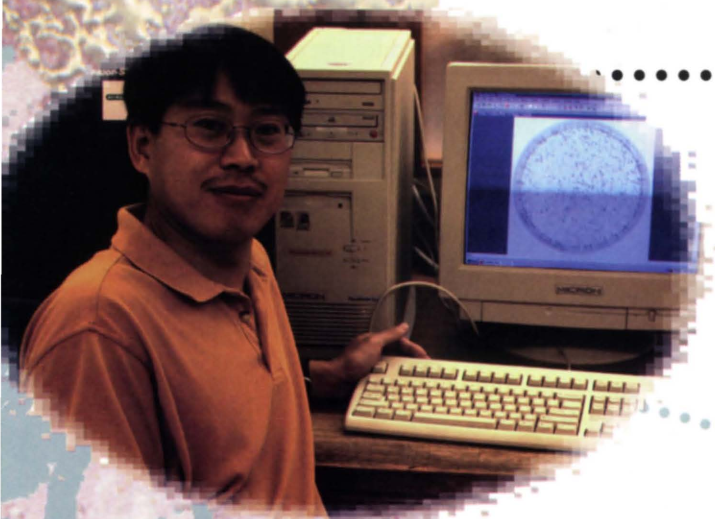
Dan Drost's asparagus research is part of the California Asparagus Information Support System, supported by the California Asparagus Growers.

The National Cattleman's Assocation funds research by **Charles Carpenter** regarding the influence of case-ready packaging on browning of ground beef patties.

Christopher Neale studies the impact of fieldscape heterogeneity in surface moisture and vegetation cover on a regional scale with support from NASA.

New Faculty & Staff

Seeds



Yajun Wu comes to the Department of Plants, Soils and Biometeorology (PSB) from his former position as a postdoctoral associate at Syngenta's Torrey Mesa Research Institute in La Jolla, CA. His lab at USU uses the combined approaches of plant physiology, molecular biology, genomics and proteomics to identify genes that are important for plants to respond to drought stress. Wu earned his PhD in agronomy at Univeristy of Missouri-Columbia, a BS degree in biology at Nanjing Normal University, P.R.China, and MS degrees from Southern Illinois University at Edwardville and Nanjing Normal University. He can be reached at (435) 797-8125, yajunwu@mendel.usu.edu.

Teresa Cerny joins the PSB department as an Extension horticulturist after completing her PhD at Clemson University in plant physiology. Her focus at USU will be production and water use efficiency of herbaceous plants for Utah landscapes. Cerny has several years of experience in commercial plant production and earned a BS degree in horticulture at Southern Illinois University and an MS degree at University of Tennessee in ornamental horticulture and landscape design. She can be reached at (435) 797-8124, teresac@ext.usu.edu.

Ramona Skirpstunas brings years of experience as a veterinarian and animal disease diagnostician to USU's Department of Animal, Dairy and Veterinary Sciences. Her work at USU will have a dual focus: pathology at the Utah Veterinary Diagnostic Laboratory and research involving infectious diseases in farmed fish. The new research assistant professor earned a PhD at Washington State University in veterinary science and completed a residency in pathology. She practiced veterinary medicine in Phoenix and Salt Lake City after receiving her DVM from Mississippi State University. She earned BS degrees in biology and chemistry from Northern Illinois University. Skirpstunas can be reached at (435) 797-8007, rskirps@cc.usu.edu.

Synthesis

Noelle E. Cockett Named Dean of the College of Agriculture


Gary Neuenswander

Utah State University's College of Agriculture opened a new chapter in its history on July 1 under the leadership of its new dean, Noelle E. Cockett, professor in the department of Animal, Dairy and Veterinary Sciences and former vice provost for academic affairs.

Cockett has deep roots in agriculture that began during her childhood on a ranch in Montana and that continue to grow in her professional life as a leading researcher in sheep genomics.

"I've been at Utah State for 12 years, and I've seen how our expertise in the college helps the people of this state," she said. "Our people in the college— across all disciplines — provide invaluable service, whether it's teaching, training students for careers in agriculture, offering research solutions to problems, or providing immediate help through our Extension efforts."

Cockett received her master's and doctorate degrees in animal breeding and genetics from Oregon State University. Her research centers on identifying genetic markers associated with economically important traits in livestock. Her current projects include characterization of the *callipyge* gene which causes muscle hypertrophy in sheep and identification of genetic markers for parasite resistance in sheep. Her laboratory identified the gene that causes Spider Lamb Syndrome and developed a blood test to detect the gene. In recognition of her research accomplishments, Cockett received the 1998 Young Scientist Award for the Western Section of the American Society of Animal Science. She was named a Fellow of the American Association for the Advancement of Science in 2000 and received the D. Wynne Thorne Research Award, the university's highest recognition for research, in 2002.

Synt

Steven Aust Receives Utah Governor's Medal for Science and Technology

Steven Aust, professor of chemistry and biochemistry, was among the eight scientists and educators selected this year to receive the Utah Governor's Medal for Science and Technology. The award, the state's highest recognition for scientists, recognizes individuals who have significant career achievements and/or provided distinguished service in science and technology.

Aust is internationally recognized and cited for his fundamental studies on the role of iron in the harmful oxidation of biomolecules and the degradation of lignin and harmful pollutants by white rot fungi.

"We are in the middle of a biotechnological revolution," he says. "A few years ago, if someone had told me what we'd be doing in the lab now, I'd have said, 'It can't be done.'"

Aust's work on white rot fungi centers on the organism's ability to biodegrade harmful substances such as pesticides, poisons and explosives.

"White rot fungi is the only fungi that can degrade wood," says Aust. "Our job at Utah State was to ask, 'How does it do that?' And, when we figured that out, other ideas spun off. We learned it could degrade all kinds of chemicals."

Aust is also working to understand the relationship between iron in the body and ailments such as cancer, diabetes and heart disease, Alzheimer's disease and Parkinson's disease.

"People can be intimidated by science," Aust says. "That's because the easy things have already been done. It's tough, but the rewards are incredible."

hesis

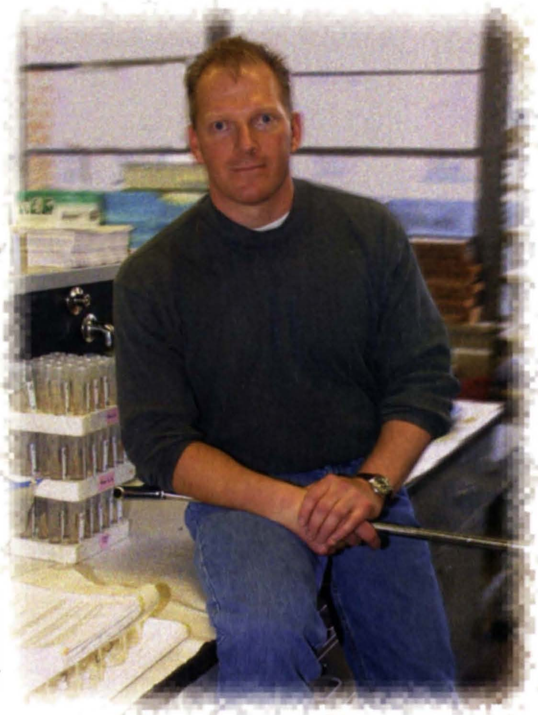
Dairy Microbiologists Honored

Utah State associate professor Jeffrey Broadbent and professor emeritus Gary Richardson were honored for their contributions to dairy microbiology research by the American Dairy Science Association (ADSA) during the organization's annual meeting in Quebec, Ontario.

Richardson was elected a fellow of the ADSA, an honor given to select association members recognizing at least 20 years of professional accomplishments in dairy science. Richardson was a leading researcher in Utah State's Department of Nutrition and Food Sciences for more than 20 years and supervised the research programs of 45 master's and doctoral degree students. His research helped revolutionize the way the cheese industry prepares and uses bacterial starter cultures.

Gary Neuenswander

Broadbent received the DSM Food Specialties Award for research in cheese and cultured products. The award recognizes his use of molecular biology and genomics to better understand and use several of the main types of bacteria used to produce cheese. Broadbent is part of the Lactic Acid Bacteria Genome Consortium, the largest effort in the U.S. to sequence the genome of bacteria important to the food industry. His work on the genome of *Lactobacillus helveticus* is helping scientists understand the contributions of specific enzymes to the development of flavor in cheese. In addition to his extensive research activities, Broadbent teaches food microbiology and a graduate class on the biotechnology of lactic acid cultures.



Gary Neuenswander

NRCS Honors Rich Koenig

Soils scientist and Extension specialist Rich Koenig recently received an Award of Merit from the United States Department of Agriculture's Natural Resources Conservation Service. The award honors Koenig's ongoing research and Extension work with farmers to improve methods of managing soils and manure. Koenig helped update the state's standards for managing nutrients in manure, such as phosphorus and nitrogen, that can adversely affect groundwater supplies. He also developed soil and manure test guidelines and materials to help educate beef and dairy producers about meeting the state's standards.

Making Pop

Gary Neuenswander

Robert Newhall, USU
Associate, and his pl

Stands of hybrid poplar and cottonwood trees seem a bit out of place growing in neat rows, their branches reaching 20-plus feet above the soil, on research farms otherwise covered with grasses, small grains and assorted vegetables. Rapid growth rate is one reason Robert Newhall, USU Extension research associate, is experimenting with this particular species of tree. But the most important work the trees do isn't high overhead, it's in the roots where they rapidly take up nutrients like nitrogen and phosphorous supplied by pig manure and commercial fertilizer.

In addition to proving themselves capable of utilizing excess nutrients from the soil that might otherwise build up and threaten water quality, the trees provide growers with a marketable crop, create windbreaks, green-screens, stir the air to potentially limit downwind odor problems and hold soil in place.

Newhall began experiments with the trees in 1997, with support from Circle Four Farms, a large pork production facility in Beaver & Iron counties. Faced with the sort of ongoing waste management problems animal producers encounter, multiplied by thousands of pigs, the company needed data on how effective the trees might be. What Newhall has found is encouraging, and suggests that poplars could be used effectively to treat municipal and animal waste in most places in Utah.

The trees at the UAES Greenville Farm typically receive 300 pounds of nitrogen per acre and 150 pounds of phosphorous per acre, considered the standard in the agroforestry industry. But Newhall has applied more than three times that amount of nitrogen and the trees continued to perform well, without any nutrients leaching below the irrigation zone.

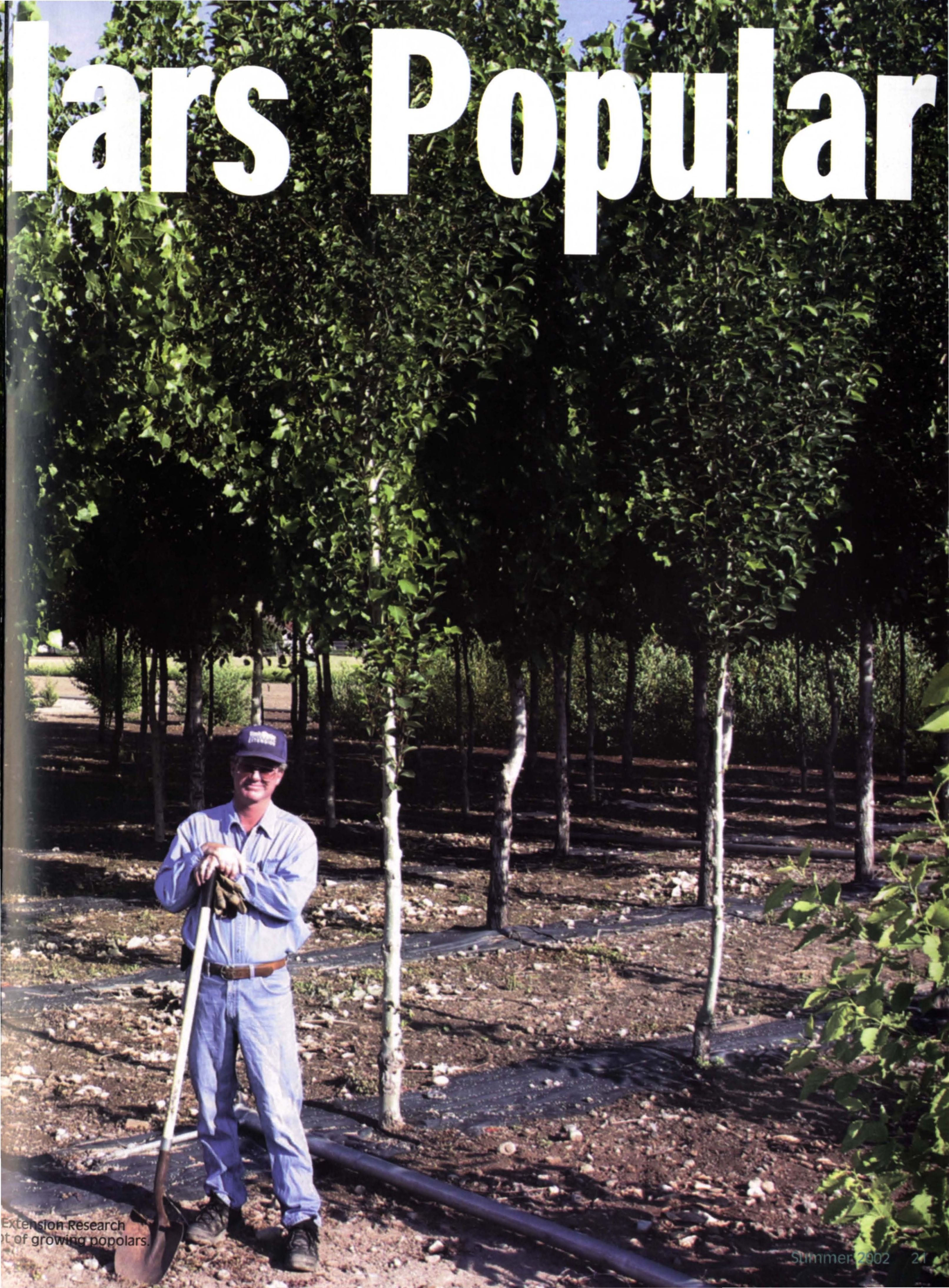
"I wanted to test what would happen with very high nitrogen levels and I really expected burnt leaves and dead trees," Newhall says. "Instead, they just got bigger and taller."

Agroforestry is well-suited to many parts of Utah and would be a good fit with existing farming and ranching operations as well as useful for communities looking for new ways to manage municipal waste, Newhall says. Good targets for agroforestry include highly erodible, flood-prone, economically marginal and environmentally sensitive lands where the goal is not to restore a natural ecosystem, but to improve sustainability and the health of the ecosystem.

Newhall says, effective agroforestry practices consider combinations of trees, crops and/or animals as a single unit. They manipulate the biological and physical interactions of those components and enhance production of more than one product at a time.

"In the case of the poplars, you can have a usable wood crop in five-to-eight years," Newhall says. "It is clean wood, though it doesn't have the heat energy of oak, but it is very benign and useful for things like pallets and crates. With 15 year's growth you

lars Popular



Extension Research
t of growing popolars.

have trees large enough to be used as veneer logs."

Another nice habit of poplars is that they resprout after cutting. One objective of Newhall's experiment is to determine how many times the trees will grow back after being harvested.

"I expect there will be a lot of interest in how these trees perform," he says. "They would be very useful in a riparian corridor planted 150 feet on both sides of a stream, mixed with willows (the subject of another of his experiments along the Sevier River at the UAES Panguitch Farm)."

The poplars are proving quite robust, although they have had a few problems. Newhall lost several trees at the UAES Evans Farm in Nibley, Utah, when erratic spring temperatures in 2002 caused one variety to leaf out and freeze repeatedly, eventually killing many of them. Pests are also present—as they are in many native poplar stands—but even without any pest management practices, the trees continue to thrive.

Newhall assures potential growers that they need not have any special silvaculture skills to successfully grow poplars. The sticks and bare root material he planted in 1999 didn't appear destined to become a small forest.

"I'm an agronomist," Newhall told participants at last summer's Greenville Farm field day. "If I can grow these, anyone can. We started with some bare root material and a lot of eight-inch cuttings of one-year-old wood. They were just a bunch of sticks we planted and hoped we had the right end up and the right end in the ground. Look at them now. We're growing a crop of trees."

— Lynnette Harris

Contact Info:
Robert Newhall
Extension Specialist, College of Agriculture
Extension/Research Associate, Plants, Soils, & Biometeorology Dept.
(435) 797-2183
bobn@ext.usu.edu

"They were just a sticks we planted and had the right end up right end in the

Robert Newhall's poplar tree research plot from July 1999 to July 2002.

bunch of hoped we and the ground."

Many of the trees in Robert Newhall's agroforestry plant trials are called hybrid clones and are true hybrids, produced by crossing native species, rather than the result of in vitro gene manipulation. The demonstration is scheduled to run at least eight years to determine the trees' ability to take up nutrients and to allow researchers to assess the quality of timber, pulp, firewood and other wood products that might be marketed.

	Tree height (feet)			Tree girth (inches)		
Planted as bare root	**'99**	**'00**	**'01**	**'99**	**'00**	**'01**
Simon Poplar	3.5	10.2	17.6	0.40	1.78	3.15
Imperial Carolina Poplar	6.5	13.4	21.2	1.27	3.07	4.07
Siouxland Cottonwood	6.2	15.0	22.0	1.22	2.89	4.31
Narrowleaf Cottonwood	7.3	12.2	16.6	1.14	2.39	3.51
Hybrid poplar clones (planted as "sticks")						
OP-367 - short season	6.8	16.6	22.1	0.96	3.05	4.44
1529 mid-season	4.5	14.4	20.1	0.56	2.25	3.52
50-197 mid-season	5.1	15.0	21.6	0.84	2.74	3.41
184-411 long season	6.2	15.5	23.6	0.99	2.74	3.97
52-225 short season	5.0	13.5	21.8	0.76	2.36	3.52
Eridano short season (new)	–	–	5.05	–	–	0.51

Gary Neuenswander

Utah State students Glen Ritchie, left, and Dennis Wright are helping make farming easier and more precise, with the use of a tool that is, if not light-years, at least several wavelengths, ahead of most conventional farm equipment.

The device uses a portable spectrometer (worn like a backpack with a few attachments) to measure wavelengths of light reflected by plants and determining whether they are nitrogen or water stressed before they exhibit visible signs of trouble. Spectrometers measure wavelengths of light, including many we cannot see with the unaided eye. A plant getting too little nitrogen or water eventually looks different from a healthy plant, but its health and productivity suffer long before it shows outward signs of stress.

The research focused on gathering data to ground-truth data gathered using satellite images and NASA aerial, infrared photographs—methods that allow growers to closely monitor the condition of crops in every part of a vast field.

Wright says the project was very important in helping him learn more about plants, understanding what they need in order to thrive, and enriched his education by giving him an opportunity to be part of a research team. "I learned how to collect and analyze data, how to write reports for different audiences (farmers, researchers, and the general public), and how projects for NASA work," he says.

The project also allowed him to talk with farmers and to put himself in their shoes. He was motivated by the idea that research he did might be valuable to farmers and help them produce the food on which we all rely. A chlorophyll meter was used to test winter wheat plants and satellite images tested the same plots. The team found that satellite images and the chlorophyll meter were both accurate in detecting levels of nitrogen stress.

The satellite images predicted yield with better accuracy than did the chlorophyll meter, but cost is a drawback. Overall, the satellite can test a larger area than the chlorophyll meter, but the meter can test individual plants and provide quantified amounts of nitrogen deficiency. As a result of his project, Wright was offered a job at Utah State as the program coordinator with the university's NASA Research Center.

Ritchie focused on using the spectrometer to detect stress levels in plants, providing more information to farmers and preparing them to change the ways they look at crops.

His studies were aimed at determining the spectral differences between nitrogen-stressed, water-stressed, and healthy winter wheat. Nitrogen-stressed plants develop a particular color, more yellow than its healthy counterparts. A water-stressed plant may remain green, but has stunted growth. The spectrometer measures the color of the plants, and—based on what is reflected—farmers can determine what corrective action to take before yields and profits suffer. Spectrometers also provide data to ground-truth satellite or aerial images of large fields that help growers see everything "up close" from a vantage point high overhead.

"The work on reflectance measurements has expanded my knowledge base by forcing me to learn a little bit more about subjects that I would not have otherwise explored, such as electronics, computer trouble-shooting, and experiment design," Ritchie says. "And it's exciting to try to craft my research toward the needs of farmers and other end-users."

Perhaps the biggest boost to his academic career has been learning how to take a subject that he knows little about, research it, troubleshoot it, and finally feel like he can use it correctly and effectively to obtain useful and repeatable results. He credits the project with helping him increase his creativity and his understanding of how the equipment works. It also makes him feel more confident knowing that he can bring these acquired skills with him as he searches for employment after graduate school.

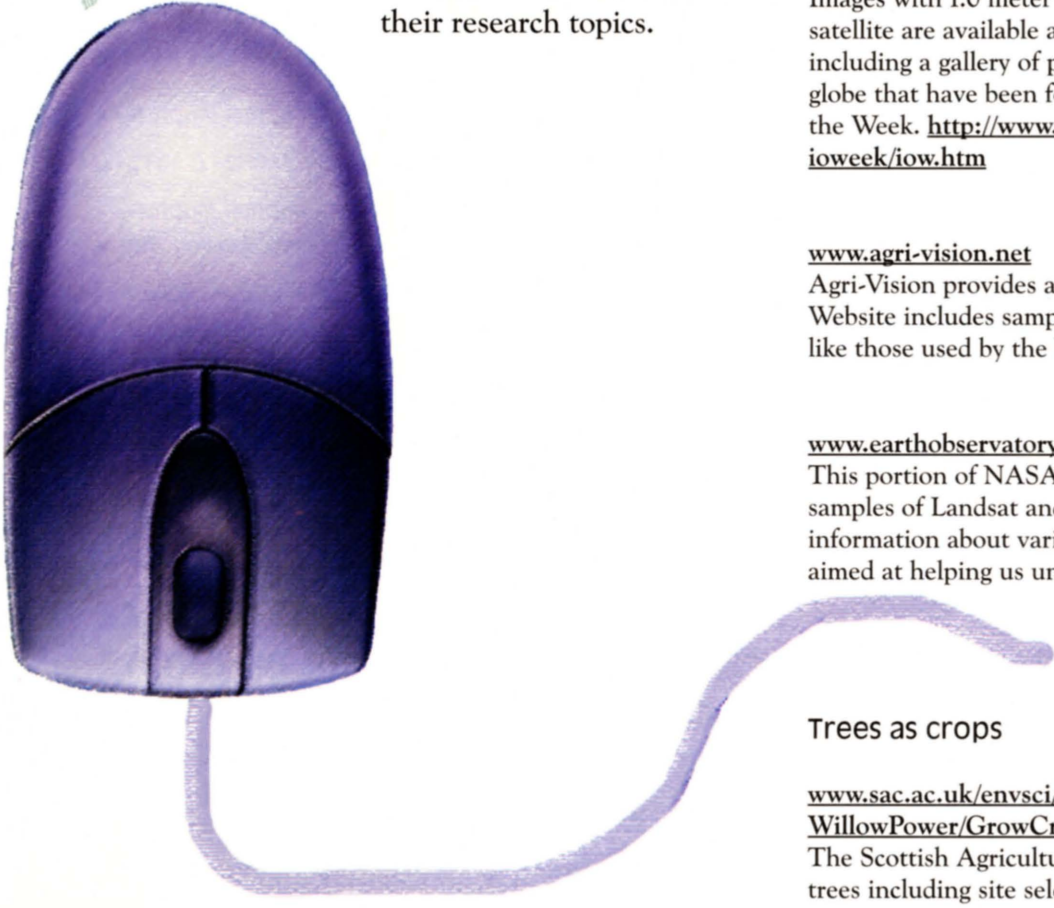
— Nathan Plott

". . .it's exciting to try and craft my research toward the needs of farmers and other end-users."

search -science on the web

Find Utah Science and other information about the people and projects of the Utah Agricultural Experiment Station online at www.agx.usu.edu

The researchers featured in this issue recommend the following Web sites for more information on their research topics.



Remote sensing images

http://extension.usu.edu/nasa
The Utah State University/NASA Space Grant Extension site.

www.digitalglobe.com
DigitalGlobe, a commercial website with the highest resolution geospatial images currently available from the QuickBird satellite with resolution to.6 meters.

Images with 1.0 meter resolution from the IKONOS satellite are available at www.spaceimaging.com, including a gallery of photographs from around the globe that have been featured as the site's Image of the Week. http://www.spaceimaging.com/gallery/ioweek/iow.htm

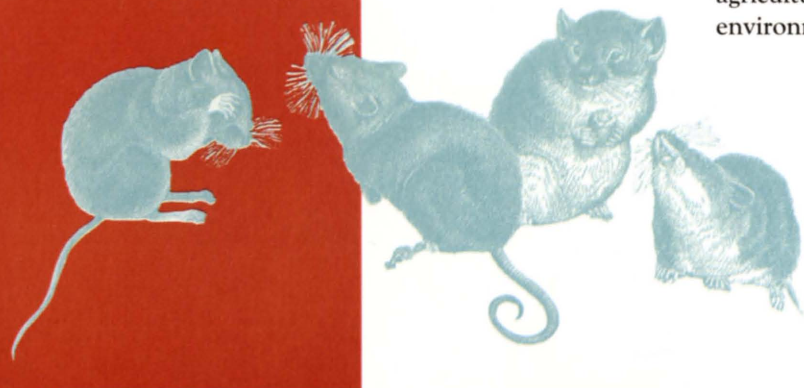
www.agri-vision.net
Agri-Vision provides aerial images to growers. The Website includes sample images made with cameras like those used by the USU research group.

www.earthobservatory.nasa.gov
This portion of NASA's vast web offerings includes samples of Landsat and other images and information about various NASA-supported projects aimed at helping us understand our planet.

Trees as crops

www.sac.ac.uk/envsci/External/WillowPower/GrowCrop.htm
The Scottish Agricultural College tips on growing trees including site selection, plantation layout, soil preparation and pest control.

wsare.usu.edu
Western Regional Sustainable Agriculture Research and Education is a USDA program focused on expanding knowledge and adoption of sustainable agriculture practices that are economically viable, environmentally sound and socially acceptable.



Utah State UNIVERSITY
Utah Agricultural Experiment Station
4845 Old Main Hill
Logan, UT 84322-4845